PROGRAM CHANNEL UNITS
OPTION SELECTION, INSTALLATION,
INSTALLATION TESTS AND TROUBLE LOCATION

This Section provides installation and maintenance information for the ITT program channel units and accessory equipment.

Whenever this Section is reissued, the reasons for reissue will be listed in this paragraph.

The equipment covered in this Section is:

(a) 5-kHz transmitting program channel unit (PGCU5T), 628320
(b) 5-kHz receiving program channel unit (PGCU5R), 628330
(c) 8-kHz transmitting program channel unit (PGCU8T), 628322
(d) 8-kHz receiving program channel unit (PGCU8R), 628332
(e) Blank card unit (BCU), 628099

Option selection for the units consists of selecting impedance options and attenuation settings. Installation consists of installing the units and BCUs. Testing consists of performing a circuit loss and frequency response test, an idle circuit noise test, and an unweighted signal-to-distortion test. These tests are also used in trouble location. Trouble location consists of isolating and correcting transmission problems. If an alarm occurs in the multiplex shelf in which the unit is located, that problem should be cleared using the procedures in Section ITTR-18-531, ITTR-18-532, or ITTR-18-533, as applicable. Note that a problem may be caused by the position or shelf in which the unit is located, rather than a fault of the equipment. This can only be determined by actually trying the unit in a different position or shelf.

In most cases, the unit will be added to an existing multiplex shelf. In those cases where the units are being installed in a new multiplex shelf, perform all installation testing on the standard channel units first before installing the units. This must be done because the standard channel units are tested on a looped terminal basis, whereas the units must always be tested on an end-to-end basis since the separate transmitting and receiving units prevent looped terminal testing of the program channel.

No routine maintenance of program channels is required; however, if it is desired to periodically test the channel to meet local requirements, this may be done using the installation tests.

This Section contains an Appendix A which provides information for adjustment of the PGCU5T/PGCU8T equalization.

CHART PAGE

1—Inspection 2
2—Option Selection 2
3—Installation Tests 6
4—Trouble Location 9

CHART 1

INSPECTION

APPARATUS

None

STEP	PROCEDURE
1	Remove equipment from shipping carton.
2	Perform an inventory to verify that all equipment listed on packing list is present.
3	Inspect the equipment for shipping damage. Report any damage to carrier immediately.

CHART 2

OPTION SELECTION

APPARATUS

Standard hand tools as required (see Section ITTR-18-400)

Office records showing:

(a) For transmitting end: Customer output level and equalized line loss (at 1020 Hz) between customer and program channel unit

(b) For receiving end: Desired customer input level and equalized line loss (at 1020 Hz) between program channel unit and customer

STEP **PROCEDURE**

Note: A screw-down option is selected by turning the option screw fully clockwise (down) until the underside of the screw head makes firm contact with the two metal pins extending through the option block. Option screws that are not selected should be turned counterclockwise (up) 1-1/2 turns from the selected position. To prevent loss and permit future adaptation of the unit to other applications, complete removal of the option screws is not recommended. DIP switch options are selected by operating the miniature switches toward the option marking on the PCB, not the switch markings.

WARNING: Too much torque on an option screw can split the option block. When selecting an option, care should be taken to make firm contact between the screw head and metal pins, without applying excessive torque to the option screw.

CHART 2 (Cont)

STEP	PROCEDURE

PGCU5T AND PGCU8T OPTION SELECTION (FIG. 1)

Note: Refer to Appendix A for information on setting the transmit unit equalizer options.

1 Determine the required impedance at the tip and ring leads of the unit.

2 For 600-ohm impedance, select option screw [600] and open (turn up) option screw [150]. For 150-ohm impedance, select option screw [150] and open option screw [600].

3 From office records, determine average program level (APL) (typically 8 vu) and equalized line loss (at 1020 Hz) between customer and program channel unit.

4 Determine proper attenuation setting from the following equation:

EQUATION: TX level setting = + 22 vu + (APL − line loss)

EXAMPLE: Assume TX APL of + 8 vu and line loss of 6 dB.

+ 22 vu + (8 vu − 6 dB) = + 22 vu + (2 vu) = + 24 dB = switch setting.

In this example for desired APL, select TX switch options [+ 8] and [+ 16]. TX switch options are marked with positive (+) numbers.

5 Set switches to proper attenuation setting by selecting appropriate DIP switch options.

6 Install PGCU in assigned connector in multiplex shelf.

Note: If receiving PGCU is to be installed in this shelf, proceed to Step 7; otherwise, proceed to Step 12.

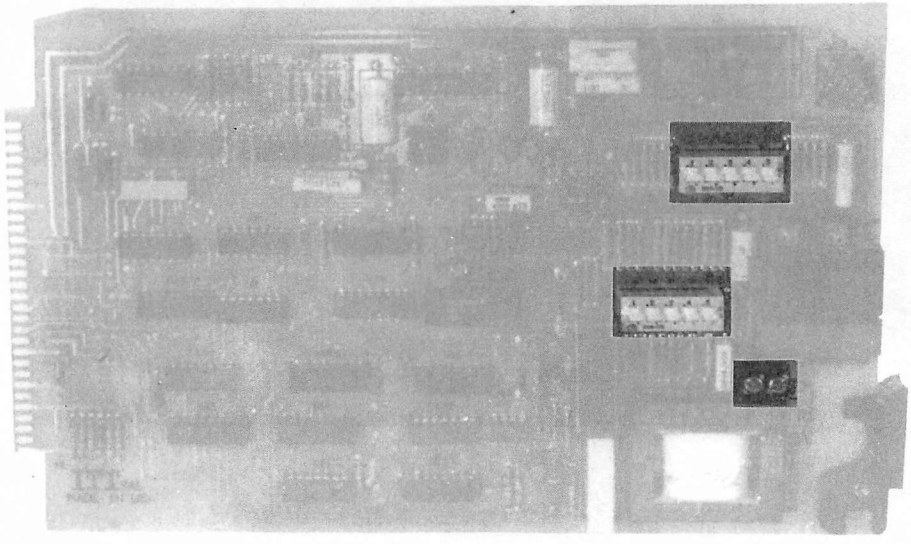


Fig. 1—PGCU5T, 628320, Option Locations

CHART 2 (Cont)

STEP	PROCEDURE

PGCU5R AND PGCU8R OPTION SELECTION (FIG. 2)

7 Determine the required impedance at the tip and ring leads of the unit.

8 For 600-ohm impedance, select option screw [600] and open option screw [150]. For 150-ohm impedance, select option screw [150] and open option screw [600].

9 Determine proper attenuation setting from the following equation:

EQUATION: RX level setting = +9 vu − (APL + line loss)

EXAMPLE: Assume RX APL of +7 vu and a line loss of 2 dB.

+9 vu − (7 vu + 2 dB) = 9 vu − (9) = 0 dB = switch setting.

In this example for desired APL, select no RX switch options. RX switch options are marked with negative (−) numbers.

10 Set switches to proper attenuation setting by selecting appropriate DIP switch options.

11 Install PGCU in assigned connector in multiplex shelf.

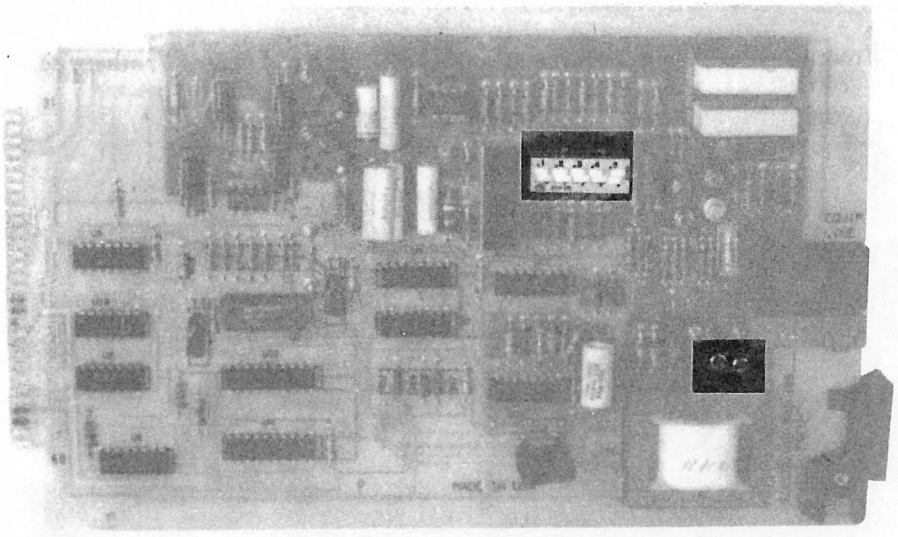


Fig. 2—PGCU8R, 628332, Option Locations

CHART 2 (Cont)

STEP	PROCEDURE

BLANK CARD UNIT (BCU), 628099, INSTALLATION

12 Insert BCU in the appropriate connectors using Fig. 3.

D448 BLANK CARD UNIT
CONDENSED INSTALLATION INSTRUCTIONS

PROGRAM CHANNELS						
PGCU IN SLOT	PUT BCUs IN SLOTS					
	D1D SEQUENCE		D2 SEQUENCE		D3 SEQUENCE	
	5 kHz	8 kHz	5 kHz	8 kHz	5 kHz	8 kHz
1	7	5 & 9	2	7 & 10	13	9 & 17
2	8	6 & 10	1	8 & 9	14	10 & 18
3	9	7 & 11	4	6 & 12	15	11 & 19
4	10	8 & 12	3	5 & 11	16	12 & 20
5	11	1 & 9	6	4 & 11	17	13 & 21
6	12	2 & 10	5	3 & 12	18	14 & 22
7	1	3 & 11	8	1 & 10	19	15 & 23
8	2	4 & 12	7	2 & 9	20	16 & 24
9	3	1 & 5	10	2 & 8	21	1 & 17
10	4	2 & 6	9	1 & 7	22	2 & 18
11	5	3 & 7	12	4 & 5	23	3 & 19
12	6	4 & 8	11	3 & 6	24	4 & 20
13	19	17 & 21	14	19 & 22	1	5 & 21
14	20	18 & 22	13	20 & 21	2	6 & 22
15	21	19 & 23	16	18 & 24	3	7 & 23
16	22	20 & 24	15	17 & 23	4	8 & 24
17	23	13 & 21	18	16 & 23	5	1 & 9
18	24	14 & 22	17	15 & 24	6	2 & 10
19	13	15 & 23	20	13 & 22	7	3 & 11
20	14	16 & 24	19	14 & 21	8	4 & 12
21	15	13 & 17	22	14 & 20	9	5 & 13
22	16	14 & 18	21	13 & 19	10	6 & 14
23	17	15 & 19	24	16 & 17	11	7 & 15
24	18	16 & 20	23	15 & 18	12	8 & 16
Allowed: Mode 1, 2, or 3 with local or loop timing.						
Not Allowed: Any unit requiring more than 1 channel slot cannot share the same BCU slot.						

DSODP/56K AND OCUDP/56K CHANNELS (D3 SEQUENCE) (with error correction feature enabled)									
If DSODP or OCUDP is in slot:	1	2	3	4	. . . .	21	22	23	24
Put this BCU in slot:	2	3	4	5	. . . .	22	23	24	1

Fig. 3—BCU, 628099, Installation (BCU Label)

CHART 3

INSTALLATION TESTS

APPARATUS

REQUIRED AT TRANSMITTING END:

1—Oscillator (Hewlett-Packard 236A Telephone Test Oscillator or equivalent with frequency range up to 11 kHz and less than 46 dB total harmonic distortion)

1—600-ohm resistor

REQUIRED AT RECEIVING END:

1-Transmission measuring set (TMS)/noise measuring set (NMS) (Hewlett-Packard 3555B Transmission and Noise Measuring Set or WE J94021A TMS or equivalent TMS with frequency response up to 11 kHz and WE J4003C NMS with 497B Network for program weighting or equivalent NMS having program weighting, 600-ohm impedance, and damped response)

1—Distortion analyzer (Hewlett-Packard 334A Distortion Analyzer or equivalent capable of measuring total harmonic distortion by rejecting test tone and measuring remaining combined distortion components)

1—Repeating coil (WE 111C or 119E or equivalent)

1—600-ohm resistor

STEP	PROCEDURE

Note 1: If any requirements are not met, refer to Chart 4 for trouble location procedures.

Note 2: At both ends, set for 600-ohm impedance and ensure all TX equalizer switches are not selected.

Note 3: The oscillator must provide a −15 dBm0 test level in order for the following tests to be performed. However, the −15 dBm0 level is not a true level but is referenced to what is considered to be 0 dBm0. The following equation explains how the 0 dBm0 level is obtained:

EQUATION: (APL in vu) + 7 dBm0 = 0 dBm0

0 dBm0 − 15 dB = −15 dBm0

EXAMPLE: 4 vu + 7 dBm0 = 0 dBm0
11 dBm = 0 dBm0

11 dBm − 15 dB = −15 dBm0
−4 dBm = −15 dBm0

CHART 3 (Cont)

STEP	PROCEDURE
	CIRCUIT LOSS AND FREQUENCY RESPONSE TEST
1	At transmitting end, set oscillator to 1020 Hz at – 15 dBm0 and connect it to EQUIP jack on front edge of program channel unit.
2	At receiving end, connect TMS to EQUIP jack on front edge of program channel unit.
	Requirement: TMS reads – 15 dBm0.
	EXAMPLE: If transmitting end attenuation is set to 6 vu and receiving end attenuation is set to 9 vu, set oscillator to – 2 dBm. TMS will read + 1 dBm.
3	At transmitting end, set oscillator to 50 Hz at – 15 dBm0.
	Requirement: TMS at receiving end reads within ± 0.5 dB of level measured in Step 2.
4	At transmitting end, set oscillator to 3000 Hz at – 15 dBm0.
	Requirement: TMS at receiving end reads within ± 0.5 dB of level measured in Step 2.
5	At transmitting end, set oscillator to 5000 Hz at – 15 dBm0.
	Requirement: TMS at receiving end reads within ± 0.5 dB of level measured in Step 2.
	Note: Proceed to Step 7 for PGCU5T and PGCU8T.
6	At transmitting end, set oscillator to 8000 Hz at – 15 dBm0.
	Requirement: TMS at receiving end reads within ± 0.5 dB of level measured in Step 2.
7	At transmitting end, set oscillator to 6200 Hz at – 15 dBm0 for PGCU5T or 9400 Hz at – 15 dBm0 for PGCU8T.
	Requirement: TMS at receiving end reads 3 dB down from level measured in Step 2.
8	At transmitting end, set oscillator to 11 kHz at – 15 dBm0.
	Requirement: TMS at receiving end reads 30 dB down (minimum) from level measured in Step 2.
9	Remove all test connections at both ends.
	IDLE CIRCUIT NOISE TEST
	Note: The following test should be made for at least 10 minutes during the office busy hour.
10	At transmitting end, terminate T and R at EQUIP jack on front edge of program channel unit with 600-ohm resistor.

CHART 3 (Cont)

STEP	PROCEDURE

11 At receiving end, connect NMS (set for program weighting and 600-ohm termination) to T and R EQUIP jack on front edge of program channel unit.

Requirement: NMS reads less than 20 dBrn0.

EXAMPLE: If receiving end level is set to 5 vu, the NMS will read 32 dBrn (32 dBrn − (5 vu + 7 dB) = 20 dBrn0.

Note: This requirement is equivalent to overall program requirement of less than 35 dBrn with program weighting at a +8 vu point. If this requirement cannot be met, it may be possible to select another multiplex shelf position or multiplex shelf with lower idle circuit noise in order to meet requirement.

12 Using NMS monitoring receiver, adjust for an on-scale meter indication and listen for noise and crosstalk.

Requirement: No voice (words or syllables) or other program-degrading transients should be heard.

13 Remove all test connections at both ends.

UNWEIGHTED SIGNAL-TO-DISTORTION TEST

Note: This test is a measurement of total distortion, including that from quantizing, spurious responses, and harmonics present. The repeating coil must be connected as instructed to reduce the effect of longitudinal noise on the unbalanced analyzer output.

14 At transmitting end, set oscillator to 1 kHz at 0 dBm0 and connect to EQUIP jack (J1A) on front edge of program channel unit.

15 At receiving end, connect test equipment to T and R EQUIP jack on front edge of program channel unit as shown in Fig. 4.

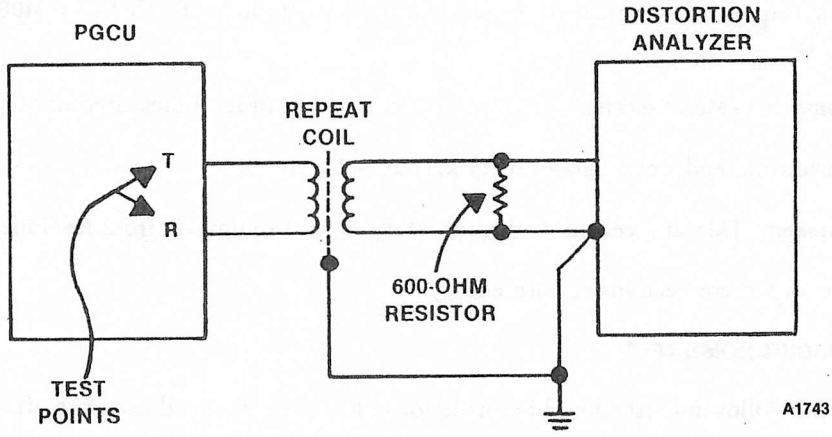


Fig. 4—Test Connections at Receiving End for Unweighted Signal-to-Distortion Level

CHART 3 (Cont)

STEP	PROCEDURE
16	Adjust distortion analyzer to measure received test tone level and record indication.
17	Adjust distortion analyzer to reject test tone and measure distortion level.
	Requirement: Test tone level minus distortion level equals 35 dB or (numerically) greater.
	Note: Failure to meet the requirement may be influenced by characteristics of the multiplex shelf. Use of a different multiplex shelf for the program channel unit may provide sufficient improvement to meet the requirement.
18	Remove all test connections at both ends.
19	At both ends, return option switches to previous settings.
20	Make final connections to both transmitting and receiving metallic broadcast facilities.

CHART 4

TROUBLE LOCATION

APPARATUS

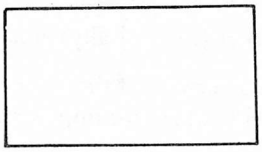
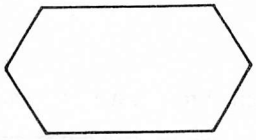
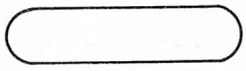
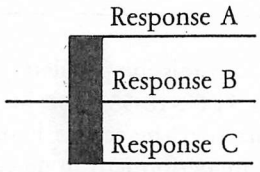
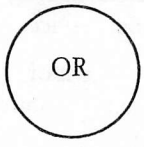
As required by tests of Chart 3, when applicable

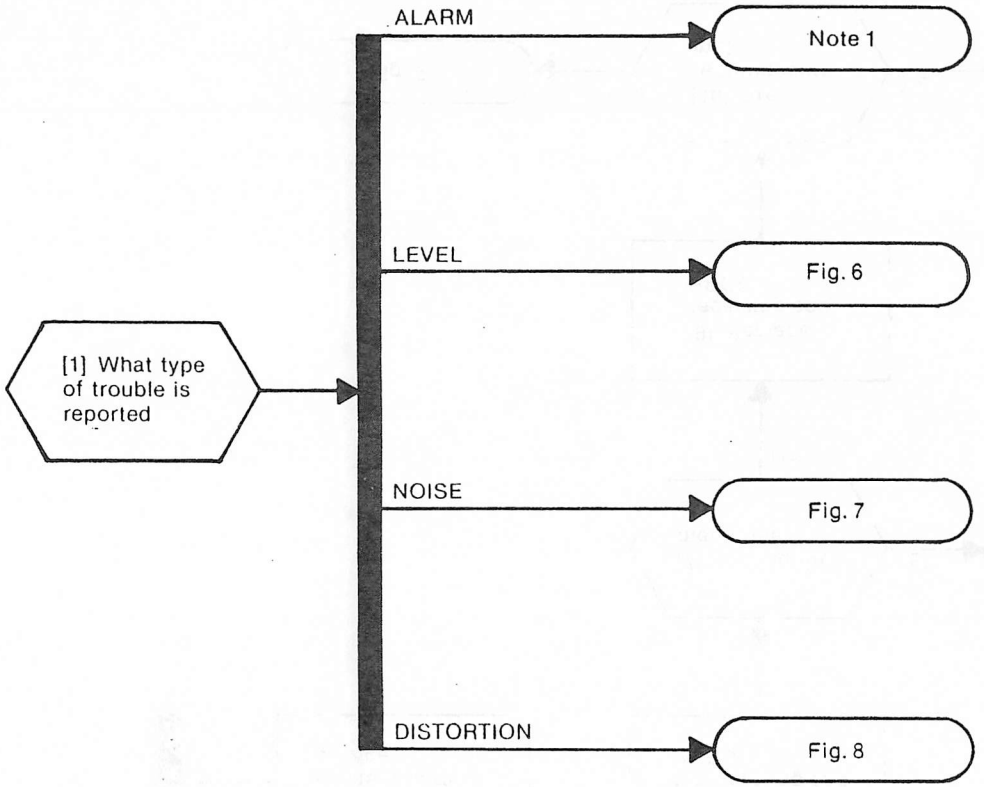
STEP	PROCEDURE
	Note 1: The information contained in this chart applies only to transmission problems. For alarm trouble location, refer to Section ITTR-18-531 for Mode 1, Section ITTR-18-532 for Mode 2, or Section ITTR-18-533 for Mode 3. In the event of alarm trouble, ensure that the service is patched to another suitable circuit or turned down before the trouble location tests are performed. In no case should the terminal be looped before patching or turning down the program channel service.
	Note 2: The customer may report excessive noise as a result of a measurement of "noise in the presence of signal." This is the PCM quantizing noise which is greater than idle circuit noise (steady without tone) and not considered to be a significant impairment to program quality.
	Note 3: The trouble location procedures are presented in a GO/NO GO format. All trouble location should begin by performing the procedures in Fig. 5; all detailed trouble location procedures are referenced from Fig. 5. Explanations of the symbols used in the diagrams are provided in Table A.
	Note 4: When replacing a unit during trouble location procedures, the options on the new unit should be selected identically to the options on the replaced unit. When a unit is replaced and the trouble does not clear, the original unit should be reinstalled in its position. When testing or replacing channel units, the remainder of the terminal (or digroup) may remain in service (except when performing a procedure on a looped basis). However, when common equipment units are replaced, the terminal (or digroup) must be taken out of service.

CHART 4 (Cont)

TABLE A

SYMBOL DESCRIPTIONS

SYMBOL	NAME	DESCRIPTION
	Instruction Block	An instruction block is used to enclose a discrete statement. Each block has a reference number in brackets [ ]. This is for reference only and does not imply sequence.
	Decision Block	A decision block is used to enclose an interrogative statement. Each block has a reference number in brackets [ ]. This is for reference only and does not imply sequence. Each block normally has two responses (Yes-No); however, multiple responses are possible. For example, two ''Yes'' responses will be numbered Yes (1) and Yes (2). Always try the (1) response first. If the problem is not corrected, repeat the procedure with the (2) response.
	Reference Bubble	A reference bubble is used at the termination of a flowline to represent an exit from that figure or subfigure.
	Exclusive OR Operation	The Exclusive OR operation symbol is used when the user must select one of several responses. One, and only one, of the responses will occur at a given time.
	OR Operation	The OR operation symbol is a junction point within a procedure. It is used where the same result can be accomplished by performing different instructions. Once a single input instruction has been successful, the result has been accomplished.
	End-of-Procedure	The end-of-procedure symbol is used to denote that the flow-charted procedure, as defined by the procedure title, has been completed.



NOTES

1. Refer to Section ITTR-18-531, ITTR-18-532, or ITTR-18-533, as applicable.

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Fig. 5—Alarm Trouble Location

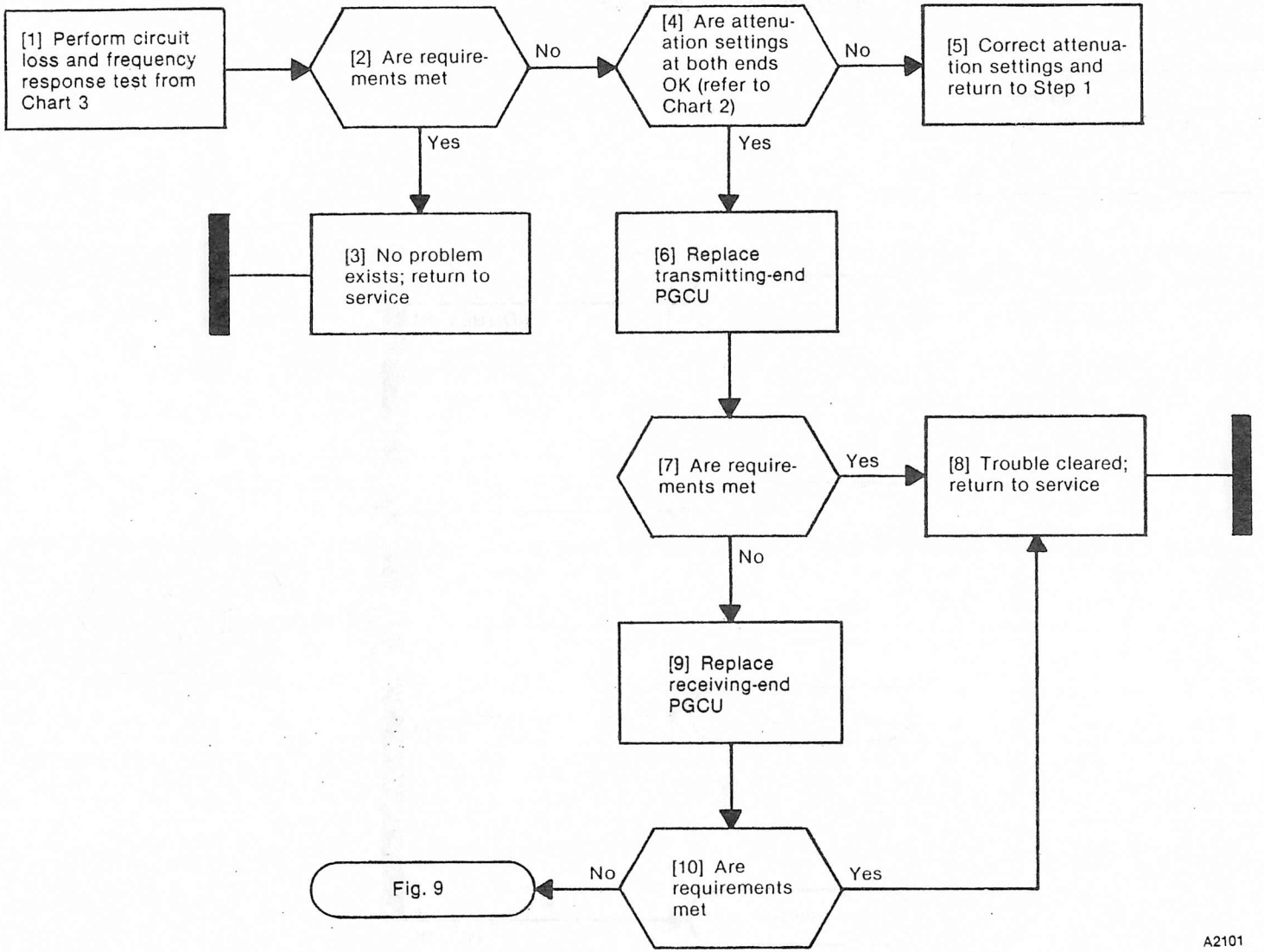


Fig. 6—Level Trouble Location

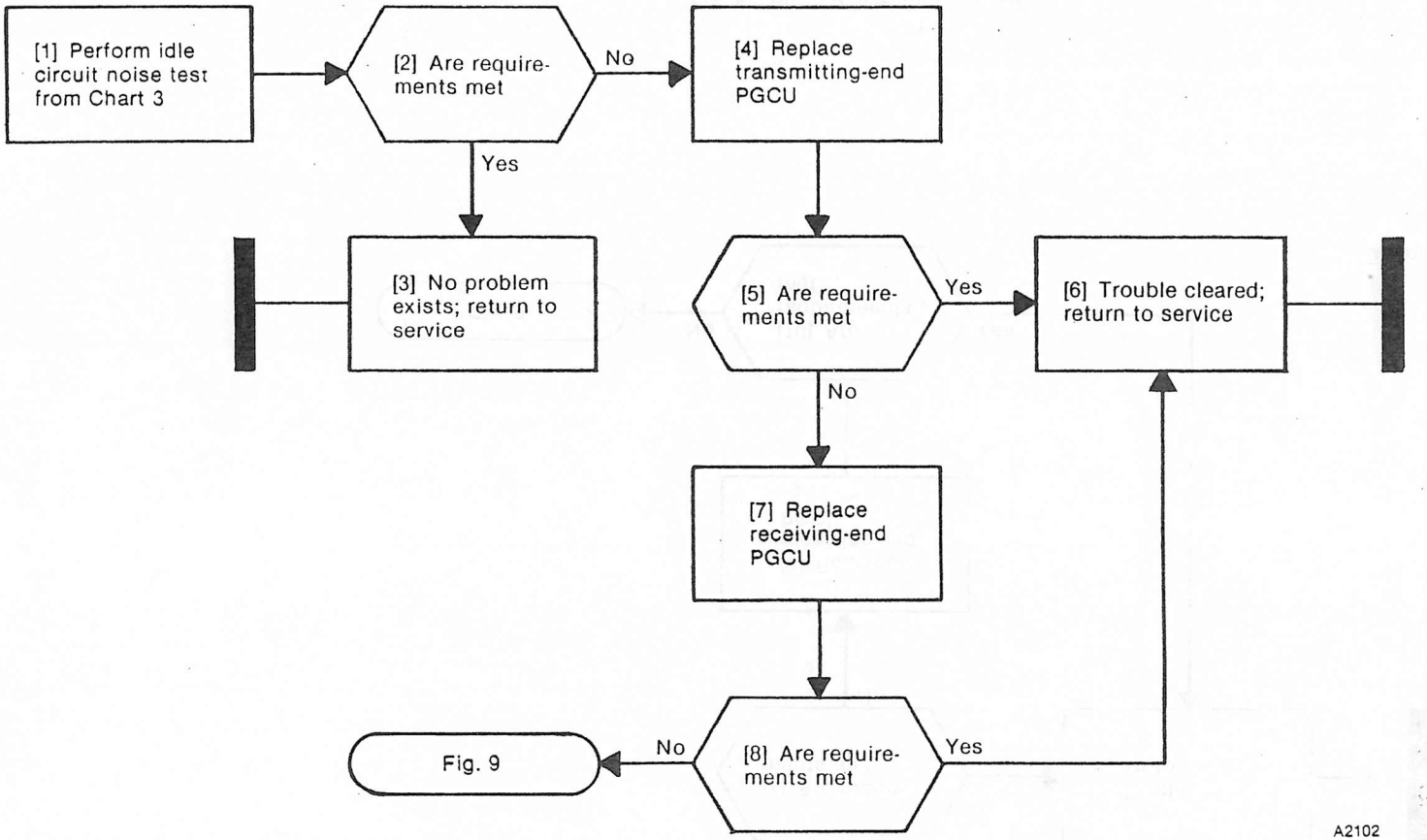


Fig. 7—Noise Trouble Location

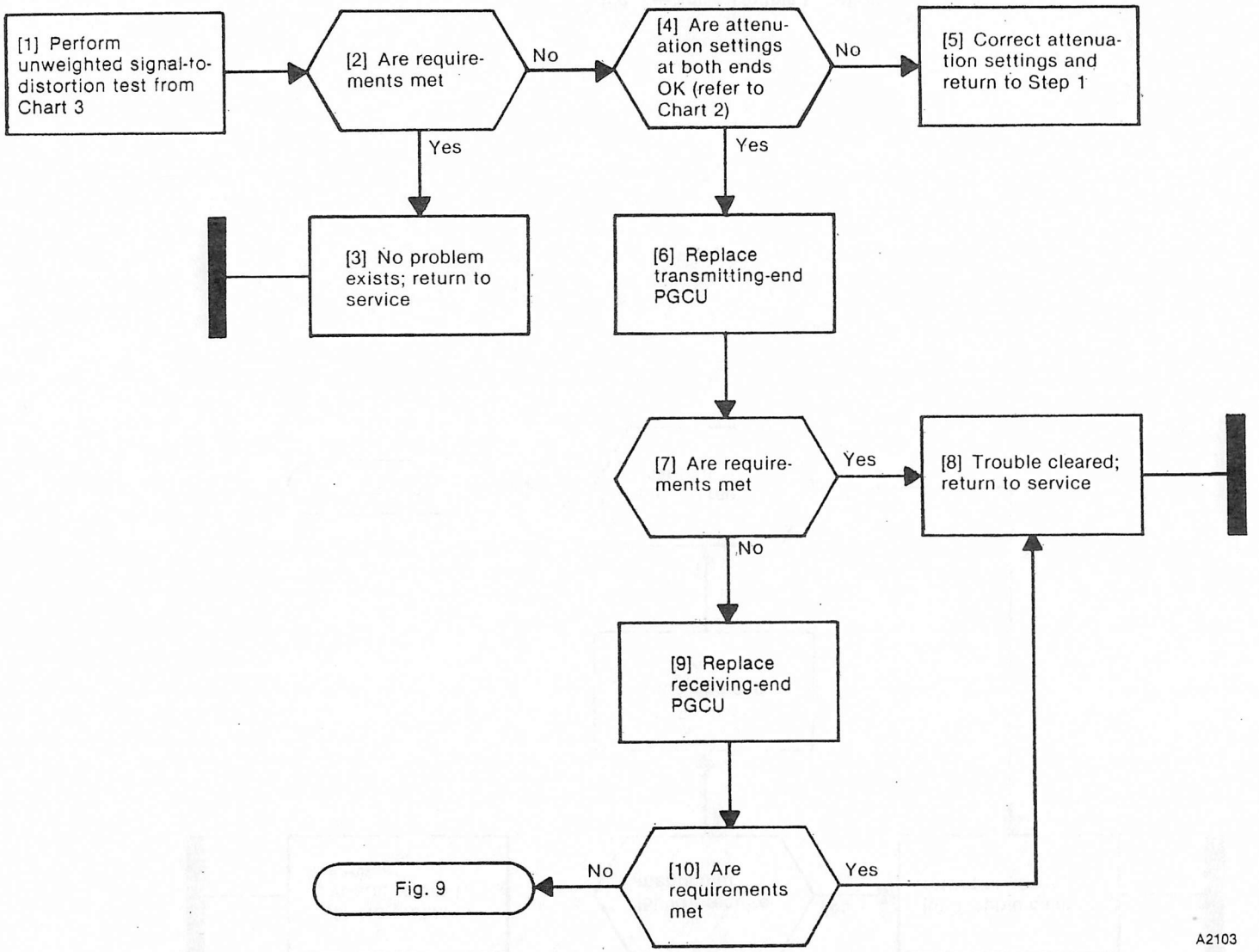


Fig. 8—Distortion Trouble Location

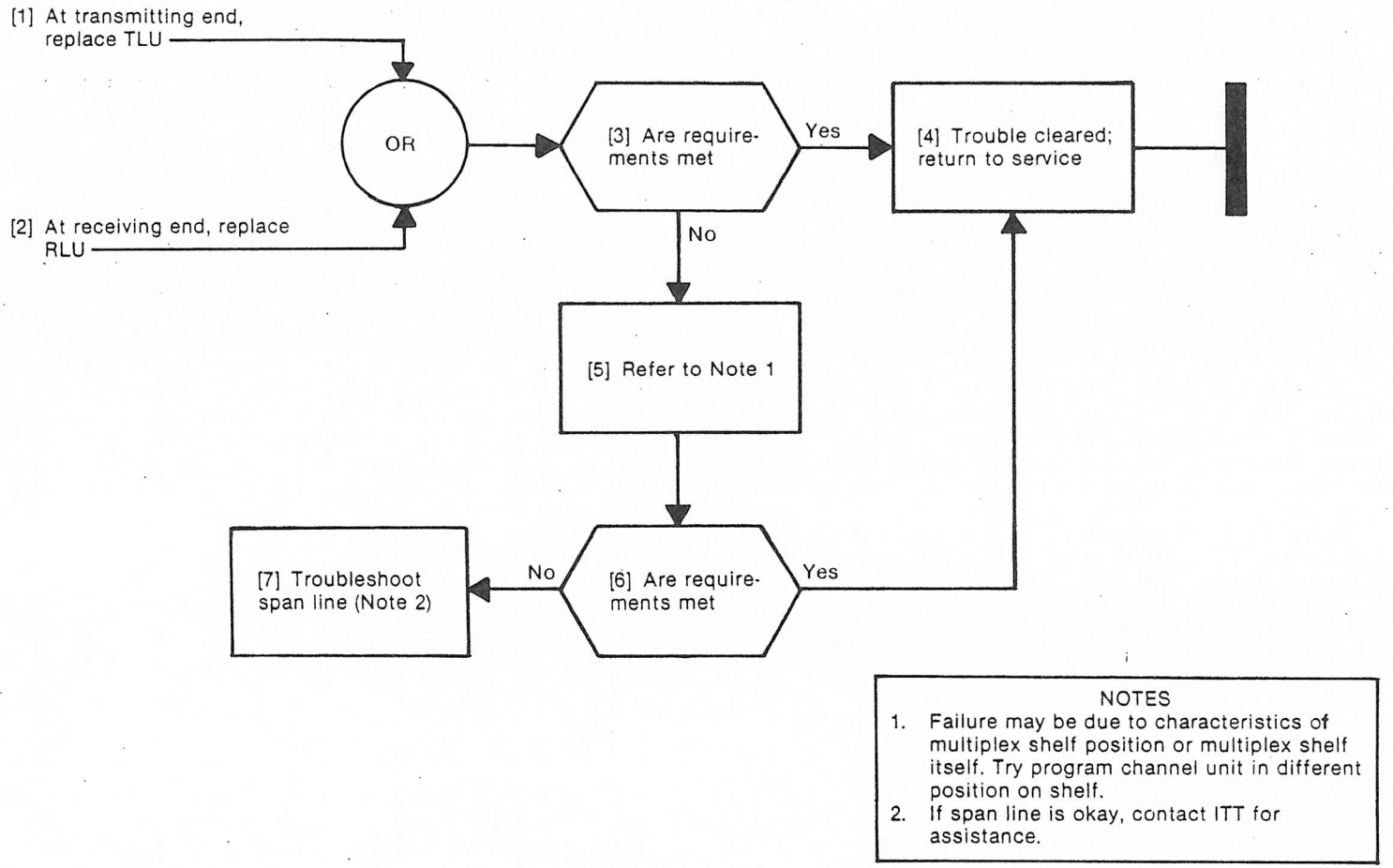

[1] At transmitting end, replace TLU
OR
[2] At receiving end, replace RLU
[3] Are requirements met
Yes
[4] Trouble cleared; return to service
No
[5] Refer to Note 1
[6] Are requirements met
Yes
No
[7] Troubleshoot span line (Note 2)
NOTES
1. Failure may be due to characteristics of multiplex shelf position or multiplex shelf itself. Try program channel unit in different position on shelf.
2. If span line is okay, contact ITT for assistance.
A2104

Fig. 9—Trouble Location

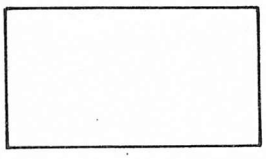
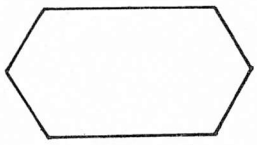
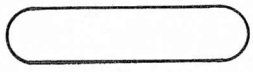
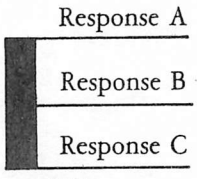
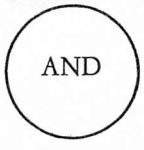
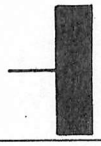
EQUALIZER ADJUSTMENT

APPENDIX A

TO

SECTION ITTR-18-460

SYMBOL DESCRIPTIONS

SYMBOL	NAME	DESCRIPTION
	Instruction Block	An instruction block is used to enclose a discrete statement. Each block has a reference number in brackets [ ]. This is for reference only and does not imply sequence.
	Decision Block	A decision block is used to enclose an interrogative statement. Each block has a reference number in brackets [ ]. This is for reference only and does not imply sequence. Each block normally has two responses (Yes-No); however, multiple responses are possible. For example, two ''Yes'' responses will be numbered Yes (1) and Yes (2). Always try the (1) response first. If the problem is not corrected, repeat the procedure with the (2) response.
	Reference Bubble	A reference bubble is used at the termination of a flowline to represent an exit from that figure or subfigure.
	Exclusive OR Operation	The Exclusive OR operation symbol is used when the user must select one of several responses. One, and only one, of the responses will occur at a given time.
	AND Operation	The AND operation symbol is a junction point within a procedure. It indicates that each input (instruction) must be performed in the order given to accomplish the output.
	End-of-Procedure	The end-of-procedure symbol is used to denote that the flow-charted procedure, as defined by the procedure title, has been completed.

SUMMARY
With tester at originating end, arrange for frequency response test. Connect transmission measuring set (TMS) to channel drop. Adjust TMS oscillator for −15 dBm0. For initial equalization, select equalizer DIP switch option using received 5000 or 8000 Hz and 1000 Hz.

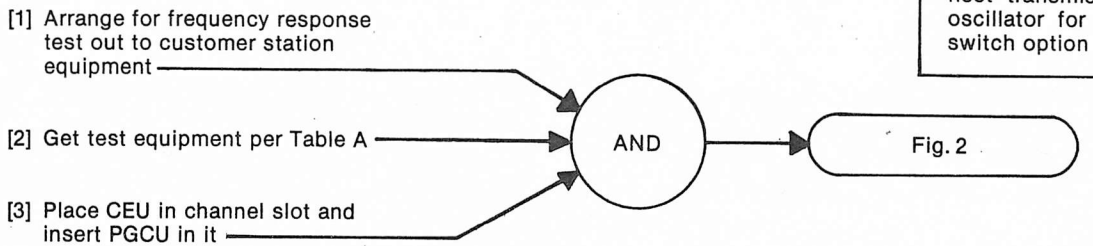
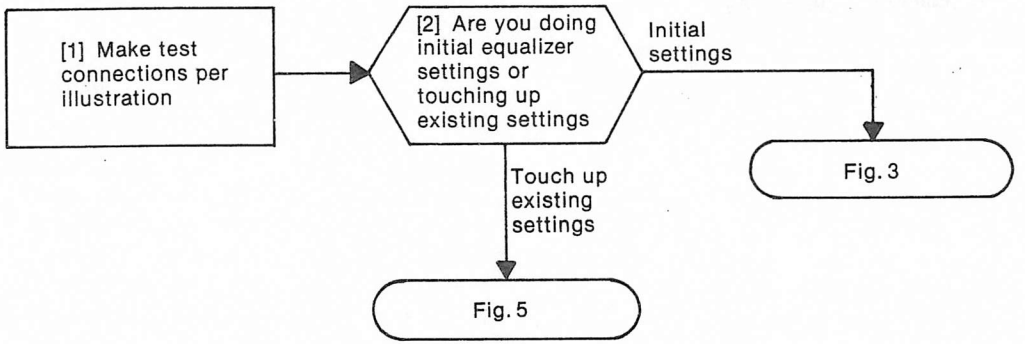

[1] Arrange for frequency response test out to customer station equipment
[2] Get test equipment per Table A
[3] Place CEU in channel slot and insert PGCU in it
AND
Fig. 2

TABLE A

EQUIPMENT REQUIRED	RECOMMENDED TYPE
Transmission Measuring Set (TMS) with Sine Wave Oscillator (0 dBm, 150/600 ohm, 50 to 8000 Hz)	HP3551A or equivalent
Patch Cord — 310 to bantam jacks	—
Channel Unit Extender (CEU)	ITT 628460-0

A2105

Fig. 1—Initial Preparation


[1] Make test connections per illustration
[2] Are you doing initial equalizer settings or touching up existing settings
Initial settings
Fig. 3
Touch up existing settings
Fig. 5

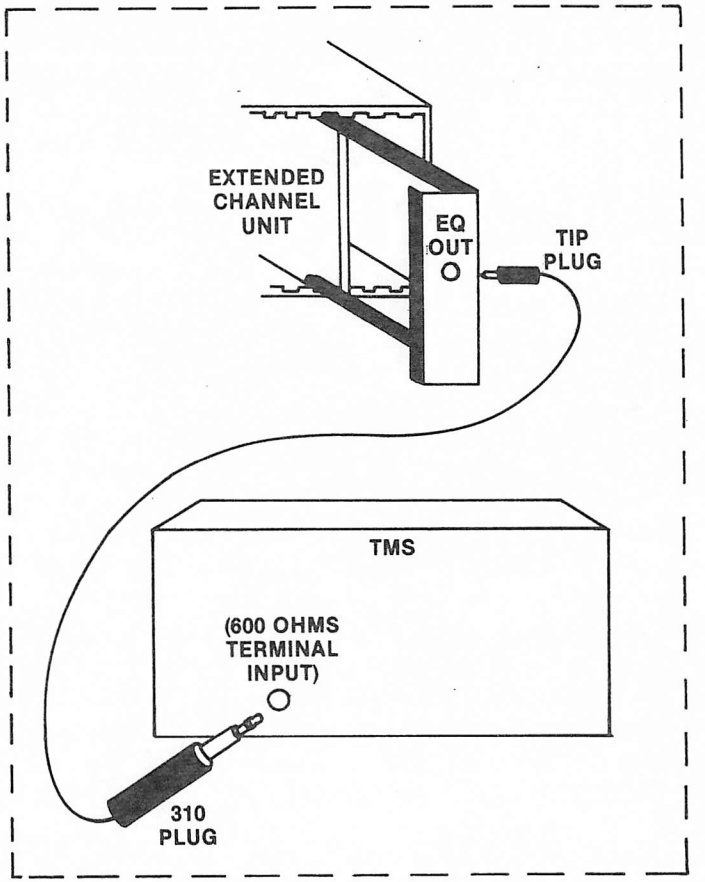


Fig. 2—Test Setup

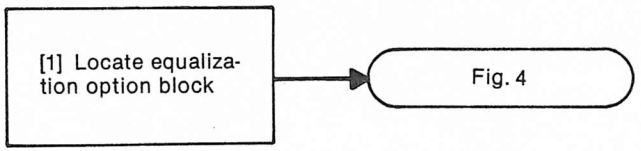


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Fig. 3—Equalizer Option Selection for Known Cable Make Up

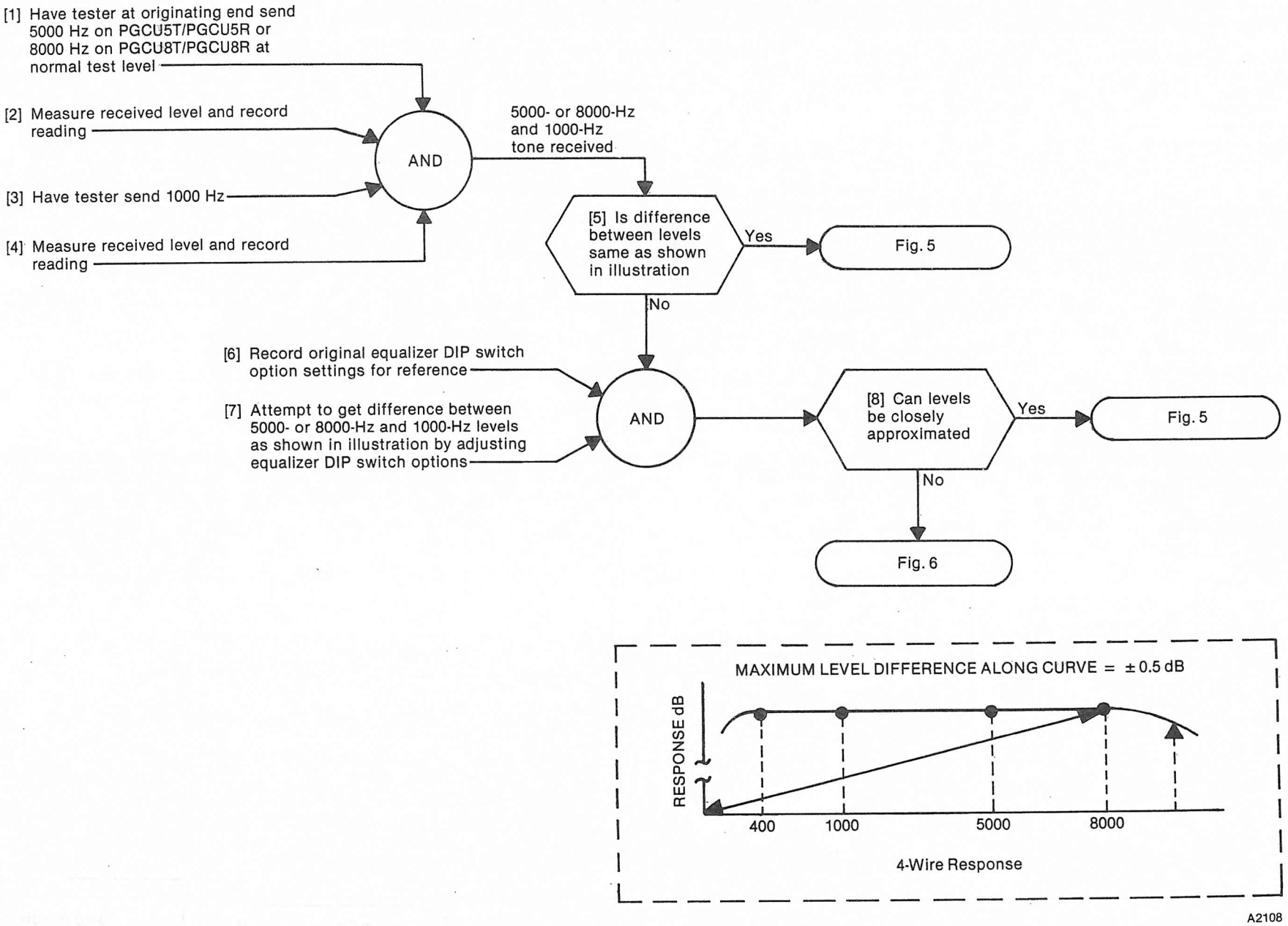
[1] Have tester at originating end send 5000 Hz on PGCU5T/PGCU5R or 8000 Hz on PGCU8T/PGCU8R at normal test level
[2] Measure received level and record reading
[3] Have tester send 1000 Hz
[4] Measure received level and record reading
AND
5000- or 8000-Hz and 1000-Hz tone received
[5] Is difference between levels same as shown in illustration
Yes
Fig. 5
No
[6] Record original equalizer DIP switch option settings for reference
[7] Attempt to get difference between 5000- or 8000-Hz and 1000-Hz levels as shown in illustration by adjusting equalizer DIP switch options
AND
[8] Can levels be closely approximated
Yes
Fig. 5
No
Fig. 6
MAXIMUM LEVEL DIFFERENCE ALONG CURVE = ±0.5 dB
RESPONSE dB
400
1000
5000
8000
4-Wire Response
A2108

Fig. 4—Equalizer Option, Course Adjustment

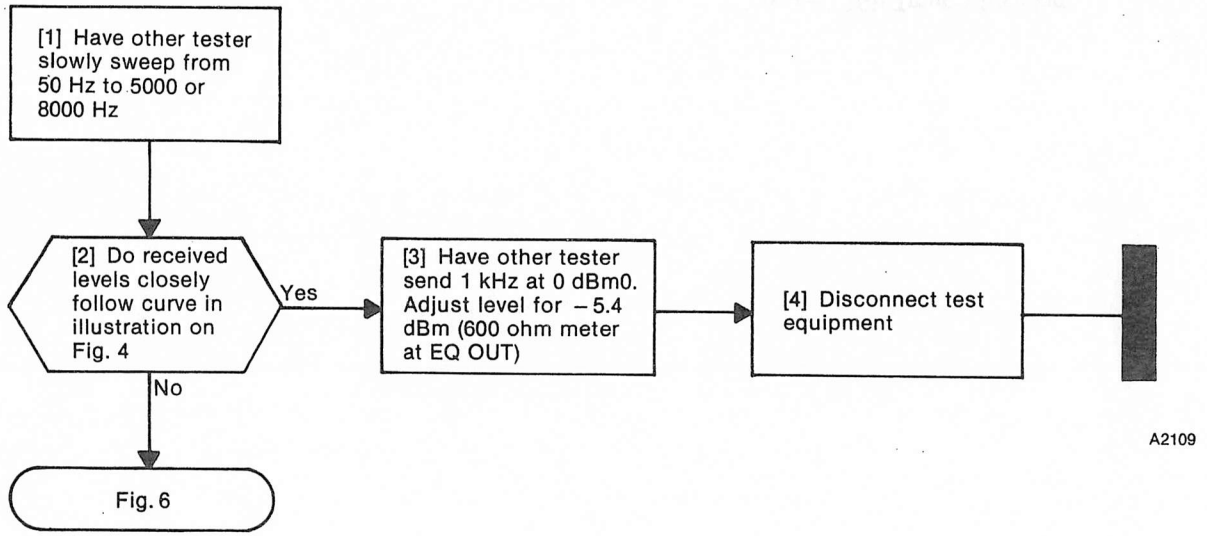
[1] Have other tester slowly sweep from 50 Hz to 5000 or 8000 Hz
[2] Do received levels closely follow curve in illustration on Fig. 4
Yes
No
[3] Have other tester send 1 kHz at 0 dBm0. Adjust level for −5.4 dBm (600 ohm meter at EQ OUT)
[4] Disconnect test equipment
A2109
Fig. 6

Fig. 5—Final Check

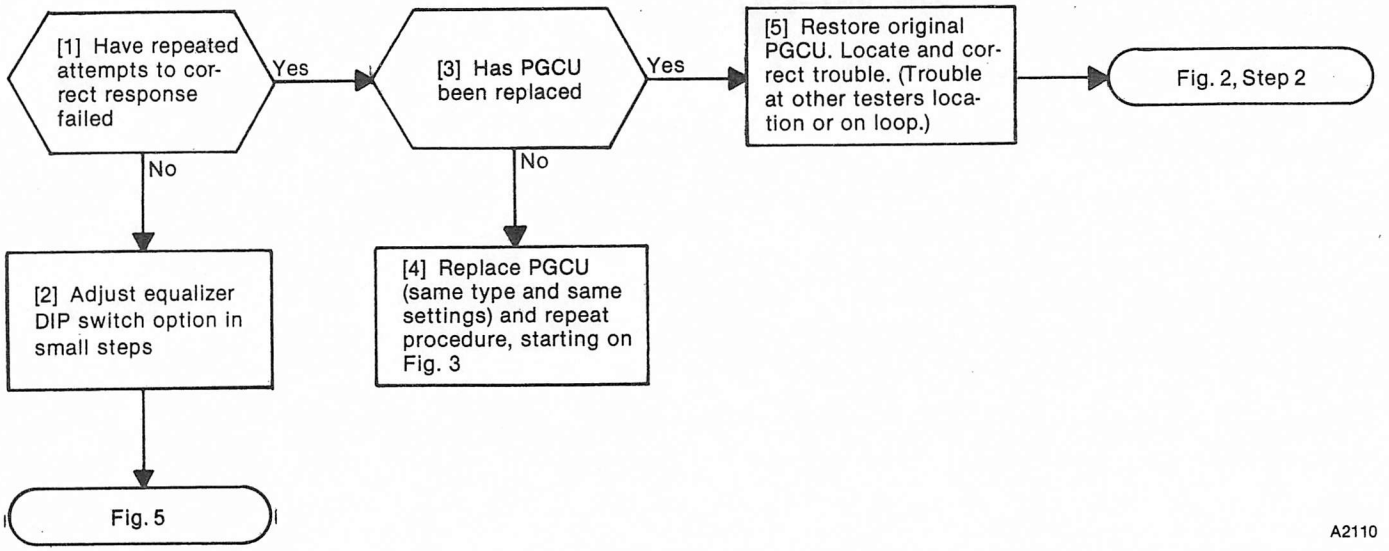
[1] Have repeated attempts to correct response failed
Yes
[3] Has PGCU been replaced
Yes
[5] Restore original PGCU. Locate and correct trouble. (Trouble at other testers location or on loop.)
Fig. 2, Step 2
No
No
[2] Adjust equalizer DIP switch option in small steps
[4] Replace PGCU (same type and same settings) and repeat procedure, starting on Fig. 3
Fig. 5
A2110

Fig. 6—PGCU Trouble Clearing